Texas Gulf Coast Residents' Expectations and Intentions Regarding Hurricane Evacuation

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SUMMARY

A survey was completed with 559 residents in the five risk areas of all five study areas along the Texas Gulf Coast from the Louisiana state line to the Mexican border. The results showed that a very large proportion of these risk area residents have previous hurricane experience, that most of them evacuated during those hurricanes, and that the majority of them intend to evacuate if their area is likely to be struck by a hurricane in the future. Indeed, even one-third of those who remained home during a previous evacuation warning intend to evacuate in a future hurricane.

Respondents indicated some concern about warning accuracy and, to a lesser extent, warning timeliness. Such concerns, along with concerns about storm risks (high winds and flooding) suggest that risk area residents are likely to comply promptly with official evacuation recommendations. However, concerns about traffic accidents, looting, loss of income, and out of pocket expenses would tend to inhibit evacuation. There is little that officials can do about loss of income and out of pocket expenses, but they can enhance evacuation warning compliance by reassuring risk area residents that serious traffic accidents are unlikely and traffic fatalities are extremely improbable. Moreover, local authorities can publicize the existence of security measures that will be taken to prevent looting while evacuees are away from home.

The survey results showed that storm category has a much more substantial effect on evacuation intentions than risk area. This finding suggests that risk area residents are very concerned about the potential for storm intensification and do not wish to take chances by remaining at home where they might be forced to ride out the storm. This is consistent with the finding that as many as one quarter of the residents in Risk Areas 2-5 and 40% of those in Risk Area 1 intend to evacuate if an adjacent risk area is advised to do so. Both of these results indicate that local officials should expect a significant level of evacuation in risk areas farther inland than, or adjacent to, the ones for which an evacuation advisory has been issued.

Respondents reported that they expected to take an average of 1.62 vehicles/household when they evacuate. This figure is approximately 20% higher than previous estimates of evacuating vehicles. In addition, 23.9% of the responding households plan to take trailers and 9.7% plan to take recreational vehicles. Conversely, the number of respondents indicating that expect to stay in public shelters (3.4%) is somewhat lower than the 5-15% that would be expected from data on previous evacuations. However, this proportion is likely to be higher in areas with low average incomes and also would be higher if people who are planning to use commercial accommodations are not able to find vacant rooms. Those respondents who expect to stay in a local shelter rather than evacuating out of the risk area (14.6% of the respondents) are a potential problem if local authorities do not plan to open such shelters. If shelters will not be opened in the risk areas, this needs to be publicized to ensure that people do not delay their evacuations for this reason.

There were some small but significant differences among study areas in terms of respondents' previous evacuation experience, influence of local media on evacuation decisions, intentions to evacuate in Category 4 and Category 5 hurricanes, intentions to take a motor home, intentions to stay with friends and relatives, expectation of receiving a timely warning, and years lived on the

Texas coast. A significant finding from analyses of respondents' intended evacuation routes and destinations is that there will be unequal loads on designated evacuation routes. This is important because it conflicts with current assumptions used in determining evacuation time estimates. Second, there was a sizeable fraction of the respondents who expect to leave the study area on roads that are not officially designated as evacuation routes. This is important because it will reduce the traffic demand on the official routes. Third, there was a significant number of respondents who failed to list a destination or a route or both. Risk area residents who have not selected a route and destination before a hurricane is imminent are likely to delay the initiation of their evacuation, perhaps until conditions are about to become dangerous for travel.

Finally, the study has some limitations, including the fact that the response rate was low and, in particular, over-represented homeowners and males. This necessarily creates uncertainties about the expectations and intentions the types of risk area residents that are not adequately represented among the respondents. However, statistical analyses suggested that the responses of homeowners did not differ in important ways from those of renters and the responses of males did not differ in important ways from those of females. An inherent limitation of behavioral intentions surveys is that people's actual behavior during an emergency is likely to differ from their behavioral intentions expressed before the emergency to the extent that the conditions arising during an emergency differ from their expectations before the emergency. Consequently, emergency planners should recognize that the behavior of the risk area population might differ—perhaps significantly—from the intentions expressed in response to this questionnaire. Emergency operations plans, especially evacuation annexes, need to be flexible enough to adapt to unexpected storm conditions and the changes that these might cause in the responses of risk area residents.

INTRODUCTION

A timely and effective evacuation of threatened areas of the Texas Gulf Coast requires accurate information about how risk area residents will respond to a hurricane evacuation warning. One important source of such information is the research on people's responses in previous emergencies. Dozens of studies have examined the processes by which public officials make decisions to recommend evacuation and threatened populations respond to warnings. The results of many such studies have been summarized by Mileti, Drabek and Haas (1975), Drabek (1986), Lindell and Perry (1992), and Tierney, Lindell and Perry (2001).

This previous research has identified many general principles about people's behavior in disasters, but it cannot answer all of the questions that arise in connection with developing local and regional evacuation plans. Specifically, people's behavior is affected by their previous experience, local conditions, and the circumstances that they encounter at the time of the event. For example, researchers have found that evacuation is affected by households' perceptions of warning sources, interpretation of warning messages, access to evacuation vehicles, concerns about the safety of persons and property, economic assets, and knowledge of a safe route to an acceptable destination. Consequently, surveys are needed to assess these conditions and people's expectations regarding what they will do if a hurricane is predicted to strike their area.

METHOD

The survey sampling procedure was designed to yield 500 households in each of the five study areas along the Texas Gulf Coast. In turn, 100 households were selected from each of the five risk areas within each study area. Finally, the risk areas were overlaid onto ZIP Code maps to determine the number of households within each risk area that were located in each ZIP Code. A list of randomly sampled names from each ZIP Code was requested from a commercial source that would approximate the desired number of households within each risk area in each study area. The numbers of households obtained from each risk area could not exactly reproduce the numbers desired because risk area boundaries differ from ZIP Code boundaries. The most significant consequence of this problem was that some households were sampled that were not in any of the five risk areas because they were in the portion of the ZIP code that was outside any of the risk areas. In addition, some respondents reported that they had received a map for the wrong study area.

Each member of the sample was sent a packet containing a questionnaire and a risk area map during the spring of 2001 and those members of the sample who did not return a completed questionnaire within three weeks were sent a second packet. This process was repeated until non-respondents had been sent three packets. A total of 559 households returned usable questionnaires for a gross response rate of 22.4%. However, 231 households were no longer at their original address, undeliverable, or returned incomplete questionnaires. These were removed from the sample without replacement. This yields an adjusted response rate of 24.6%, which is notably lower than the 31–52% range obtained by Mileti and Fitzpatrick (1993) and the 35% response rate obtained by Lindell and Prater (2000, in press). However, it also is comparable to the 27.5% response rate obtained by Lindell, Sanderson, Hwang, Wu, Lee, Jung, and Jeong (2000) and the 25.8% response rate obtained by Prater, Wenger and Grady (2000). Of the 559 respondents, 12.8% reported that they were not in any of the risk areas on their map, either

because they received the wrong risk area map or because, as noted above, they were in a portion of the ZIP code that was outside any of the risk areas.

The questionnaire respondents were predominantly male (61%) and homeowners (90%). The respondents tended to be middle-aged (arithmetic mean, M = 53.43 years) and, on average, had long resided (M = 32.69 years) in the coastal area of Texas. The respondents' households averaged 2.73 persons in size and had an average of .68 children under the age of 18 years of age.

The disproportionate numbers of males and homeowners raises questions about whether the responses to the hurricane expectations and evacuation intentions items are representative of the population as a whole. Consequently, analyses were conducted to determine if the responses of males were significantly different from those of females and if the responses of homeowners were significantly different from those of renters. Male respondents reported having a significantly larger (t_{555} = 2.55, $p < .05$) number of persons in the household (M = 2.85 persons) than did female respondents (M = 2.53 persons). However, there were no statistically significant gender differences with respect to number of years residence on the Texas coast, number of children, home ownership, or age of respondent. Homeowners tended to be older (M = 54.33 years) than renters (M = 45.19 years) and homeowners had lived significantly longer on the Texas Gulf coast (M = 33.53 years) than renters (M = 25.11 years). Both of these differences were statistically significant (t_{548} = 4.55, $p < .001$ for age and t_{545} = 3.06, $p < .01$ tenure), but there were no statistically significant differences between homeowners and renters on any of the other demographic characteristics.

There were noticeable differences in the response rates across Study Areas. Lake Sabine Study Area had 93 (16.6%), Houston/Galveston Study Area had 117 (20.9%), Matagorda Study Area had 106 (19.0%), Coastal Bend Study Area had 136 (24.3%), and the Lower Rio Grande Valley Study Area had 107 (19.1%). There also were significant differences in the response rates across Risk Areas. Risk Area 1 had 117 respondents (22.4% of the sample), Risk Area 2 had 82 (15.7%), Risk Area 3 had 141 (27.0%), Risk Area 4 had 52 (10.0%), and Risk Area 5 had 67 (12.8%). Sixty-three (12.8%) of the respondents reported that they were in none of the five risk areas.

Respondents were asked to fill out a questionnaire comprised of 49 items. In addition to the demographic items already described, the questionnaire included items on hurricane evacuation experience; evacuation intentions; anticipated evacuation time components; evacuation vehicles, destinations, and routes; evacuation considerations, hurricane risk perceptions, and warning expectations. A copy of the questionnaire is included in Appendix attached to the end of this report.

RESULTS

Respondents were asked to report what type of experience they had previously had with hurricanes. As the first row of Table 1 indicates, only a few of them (18.8%) were without previous hurricane experience. Approximately half (50.6%) had evacuated and the remainder had sheltered in a variety of structures. The second row of Table 1 displays the percentage of evacuees and non-evacuees among those who had previously experienced a hurricane evacuation

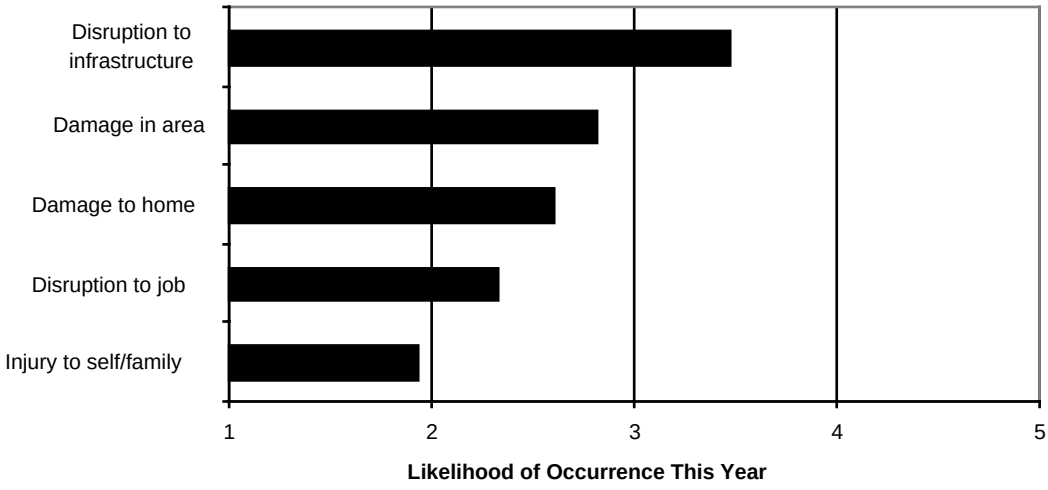
warning (the first cell of the second row is blank because those who had never been hit by a hurricane were eliminated from this calculation). These results show that a clear majority (62.3%) of those receiving a warning did evacuate.

Table 1: Previous response to hurricane evacuation warnings.

Never hit	Evacuated	Stayed in house	Stayed in apartment	Stayed in mobile home	Stayed in public shelter
18.8%	50.6%	25.2%	2.3%	0.6%	2.6%
—	62.3%	31.0%	2.8%	0.7%	3.2%

Respondents were asked to judge (on a scale from 1-5, where 1 = *not at all likely* and 5 = *almost certain*), the likelihood that a hurricane would occur this hurricane season that would cause damage to their area, damage to their home, injury to themselves or their families, disruption to their jobs, or disruption to community infrastructure such as electric, telephone, and other services. Figure 1 shows that a hurricane large enough to cause infrastructure disruption was judged to be moderately likely, followed by damage in the area, damage to the home, and job disruption. Injury to self and family was judged to be relatively unlikely.

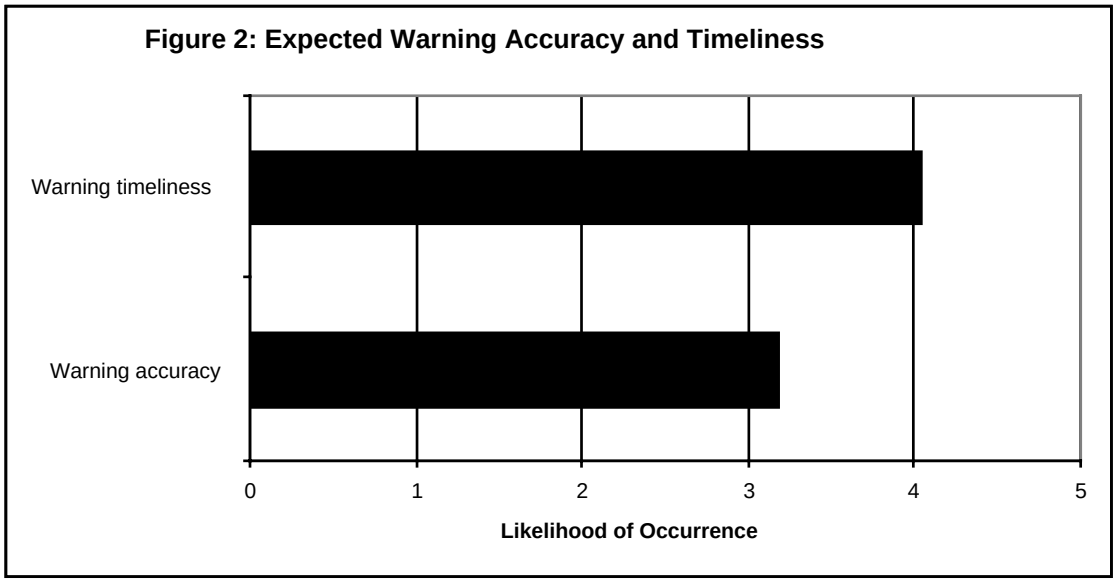
Figure 1: Expected Hurricane Impacts



Respondents also were asked to indicate their confidence in hurricane warning systems by reporting their estimate of the likelihood (on a scale from 1-5, where 1 = *not at all likely* and 5 = *almost certain*) that, if an evacuation were recommended, they would receive an evacuation warning in time (warning timeliness) and a hurricane actually would strike their neighborhood (warning accuracy). As Figure 2 indicates, respondents had a relatively high level of confidence in warning timeliness but only a moderate level of confidence in warning accuracy.

Expected warning accuracy is significantly related ($\phi = -.25$, $p < .01$) to people's judged likelihood of evacuating if a risk area next to theirs receives a warning to evacuate. The ϕ coefficient is an index that ranges from 0 (no association) to 1 (perfect association) and the

negative sign means that there is an inverse relationship in which a high expectation of accuracy is related to a low likelihood of evacuation. As Table 2 indicates, the likelihood of sympathetic evacuation rises steadily as the perceived level of prediction accuracy declines from *almost certain* to be accurate ("5") to *not at all likely* to be accurate ("1"). Here also, there also was a



negative relationship between sympathetic evacuation and perceived level of prediction timeliness (ϕ = -.11) but it was not statistically significant.

Table 2: Percentage of respondents intending to evacuate if an adjacent risk area is advised to do so, by level of prediction accuracy (1 = *low*; 5 = *high*).

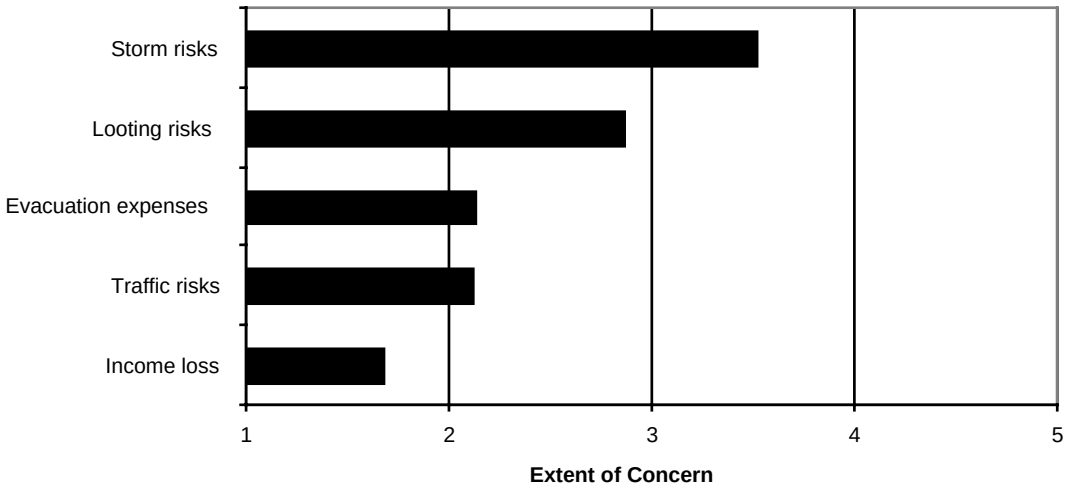
Expected prediction accuracy	Sympathetic evacuation	
	No	Yes
High	91.2% (31)	8.8% (3)
4.00	82.9% (58)	17.1% (12)
3.00	72.5% (171)	27.5% (65)
2.00	60.7% (54)	39.3% (35)
Low	50.7% (35)	49.3% (34)
Total	70.1% (349)	29.9% (149)

Respondents who had previously evacuated in anticipation of a hurricane (N = 245) were asked indicate the extent (on a scale from 1-5, where 1 = *not at all* and 5 = *to a very great extent*) to which each of a series of sources or conditions affected their decision to evacuate. As Figure 3 indicates, knowledge of their proximity to the coast was the most important situational influence in stimulating the respondents' previous evacuations, followed by coverage on the national and local media, evacuation recommendations from authorities, storm conditions, and official designations of watches and warnings. Observations of others' departures also had a significant influence, although this was notably less important than the other factors.

Figure 3: Previous Evacuation Influences

Respondents also were asked to indicate their concerns about evacuation by reporting the extent (on a scale from 1-5, where 1 = *not at all* and 5 = *very great extent*) to which their decisions to evacuate in the future would be affected by each of five considerations. As Figure 4 indicates, respondents had greater concerns about storm risk than about any of the other factors. Looting risk also was a major consideration, whereas evacuation expenses and traffic accident risks were relatively low priorities and income loss was a very minor concern.

Figure 4: Evacuation Concerns



Respondents also were asked to indicate their intentions to evacuate in each of the six categories of storm (Tropical Storm and hurricanes in Category 1 through Category 5). Table 3 indicates that there was only a slight tendency for respondents in risk areas closer to the coast to be more inclined to evacuate in each storm category, but this tendency was statistically significant only for Category 2 and higher storms. In any event, there was a consistent tendency for increasing hurricane intensity to stimulate higher levels of evacuation intentions. The increase in the proportion of evacuees is nearly constant across the first four categories of hurricane intensity, with the proportion of respondents expecting to evacuate increasing by approximately 18% with each increase in storm intensity through Category 3. After that point, the proportion of evacuees increases only slightly in a Category 4 hurricane and there is only a negligible increase beyond that for a Category 5 hurricane.

Table 3: Percentage of respondents expecting to evacuate for a Tropical Storm and hurricanes in Category 1 through Category 5, by Risk Area.

Risk Area	Tropical Storm	Category 1	Category 2	Category 3	Category 4	Category 5
1	22.3	43.1	66.4	91.9	98.2	97.3
2	28.9	42.3	51.9	71.8	87.3	93.5
3	15.6	29.6	47.3	72.9	86.7	87.5
4	14.9	26.1	46.8	72.3	78.3	85.1
5	19.0	41.4	57.4	75.4	88.3	93.3
Average	20.2	36.8	54.5	77.7	89.1	91.7

There also were no significant differences across risk areas in respondents' expectations of making an immediate response to a hurricane evacuation warning from authorities. An average of 71.3% indicated they would do so. However, there were significant differences in the respondents' propensities to evacuate in response to an evacuation recommendation in an adjacent risk area. Almost half (42.5%) of the residents of Risk Area 1 expect to leave if authorities recommend an evacuation of a risk area next to theirs. Only 25.9% of those in the remaining risk areas expected to evacuate under these conditions.

The percentage of respondents expecting to comply immediately with evacuation warning or evacuate if an adjacent risk area is warned is significantly related to their previous hurricane experience. As Table 4 indicates, those who evacuated in the past are highly likely to do so immediately (82.2%) and also to do so if an adjacent risk area is warned to evacuate (40.7%). The same is true for those who stayed in a public shelter and, to a significant extent, those who have never experienced a hurricane personally. However, those who stayed in shelters or who have no previous hurricane experience are much less likely than those who evacuated previously to use the evacuation of an adjacent risk area as a cue for their own evacuation. Those who previously remained in their houses, apartments, or mobile homes during a hurricane are the least likely to respond promptly or to plan to evacuate if an adjacent risk area is advised to do so. Nonetheless, a significant percentage of these respondents also plan to evacuate.

Table 4: Percentage of respondents expecting to comply immediately with evacuation warning or evacuate if an adjacent risk area is warned, by previous experience.

	Never hit	Evacuated	Stayed in house	Stayed in apartment	Stayed in mobile home	Stayed in public shelter
Number	78	228	112	9	2	9
Immediate response	77.4%	82.2%	45.2%	25.0%	66.7%	84.6%
Adjacent risk area	24.2%	40.7%	12.9%	0%	0%	33.3%

There also were significant gender differences with respect to one of the warning response variables. Males (33.8%) were more likely than females (23.9%) to report that they would evacuate if evacuation were recommended for an adjacent risk area ($\chi^2 = 5.77$, $p < .05$). Moreover, there were no significant differences between females (75.9%) and males (68.0%) in their expectations of responding immediately if evacuation were recommended for their area. These results are somewhat surprising because previous research suggest that females would be more likely to intend to evacuate in both conditions.

Respondents also were asked to indicate the amount of time in minutes it would take them to complete each of six response actions required to prepare for a hurricane evacuation. As Table 5 indicates, preparing to leave work and traveling from work to home are expected to take relatively little time. Gathering household members for the evacuation and securing the home by shutting off utilities and locking up are expected to take somewhat more time. Packing travel items and installing storm shutters are expected to take the most time.

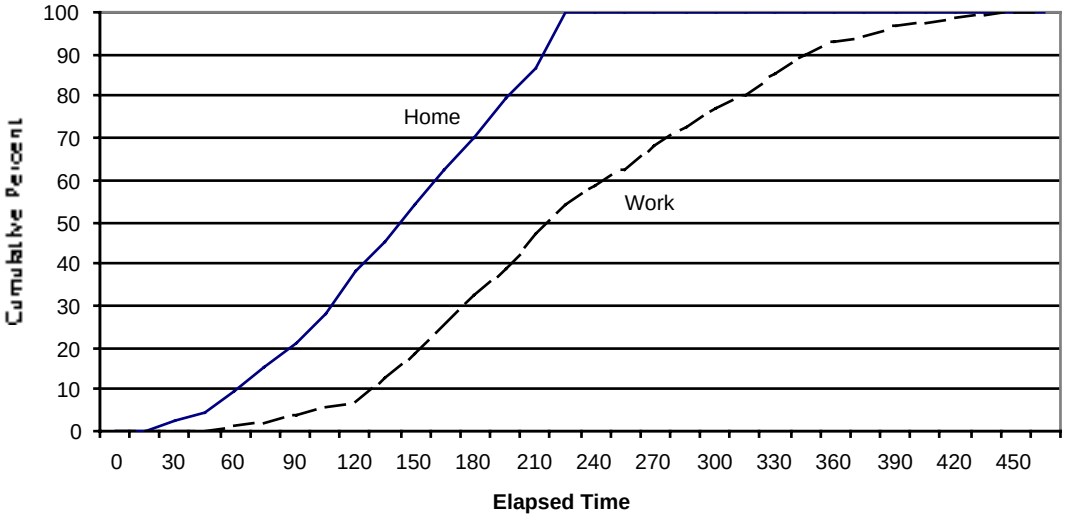
Table 5: Percentage of respondents expecting to complete evacuation time components within each time interval, by response action.

	Response Time (minutes)				
Action	0 to 15	16 to 30	31 to 45	46 to 60	More than 61
Prepare to leave work	47.9	20.5	8.2	7.7	15.7
Travel work to home	46.2	27.7	15.3	6.2	4.6
Gather household members	27.1	22.8	19.8	13.0	17.3
Pack travel items	9.3	23.6	28.5	19.0	19.6
Install storm shutters	12.1	5.4	12.9	18.1	51.6
Secure home	20.0	19.4	16.5	17.5	26.6

These responses were recoded to the midpoint of each interval so 0-15 was recoded to 10 minutes, 16-30 was recoded to 23 minutes, 31-45 was recoded to 38 minutes, 46-60 was recoded to 54 minutes, and more than 61 minutes was recoded to 75 minutes. The estimates of the time components were summed to produce cumulative distributions of time components for departure from work (*Work*) and departure from home (*Home*), which are displayed in Figure 5. The *Work* curve indicates that the earliest evacuees will take about 45 minutes to enter the evacuation routes if they are at work when an official evacuation recommendation is released and they have

had no opportunity to engage in any preparations prior to receiving a warning. It will be about four hours after receiving a warning before half of the risk area residents have completed their preparations to evacuate and approximately six hours for 90% of the risk area residents to prepare to evacuate.

Figure 5: Cumulative Preparation Times



The *Home* evacuation preparation time is substantially lower because it generally is not necessary for household members to return home from work and members of the household are already united during evenings and weekends. In such cases, evacuation preparation would consist only of packing the items people need while away from home, installing shutters, and securing the home. The reduced number of preparation activities is reflected in the substantially lower estimates of preparation time displayed as the cumulative preparation time. The cumulative distribution curve for *Home* shows that evacuations are likely to begin at 15 minutes, that the average preparation time is approximately two and three-quarters hours, and 90% of the evacuees will be prepared to leave within three and a half hours after receiving an evacuation warning. Preparation times will be even shorter if people already have installed storm shutters (or have none to install) and have packed for the trip.

The overwhelming majority of the respondents indicated that they would take their own vehicles (97.2%) rather than get rides with others (1.9%), take public transportation (0.4%) or use other transportation modes (.6%). Respondents reported that they would take an average of 1.62 vehicles per household and an average of .29 trailers (including boats and campers) per household. A total of 9.7% of the respondents indicated that they would take motor homes or recreational vehicles when evacuating. There were no significant differences between homeowners and renters on these variables.

Consistent with the findings of previous evacuation research (e.g., Drabek, 1986; Lindell & Perry, 1992; Mileti, Drabek & Haas, 1975; Tierney, Lindell & Perry, 2001), the majority of the respondents expect to stay with friends and relatives (46.3%), while the next most popular

accommodations are expected to be commercial hotels or motels (32.9%). Another 4.3% of the respondents expect to stay in campers or trailers, 3.4% expect to stay in public shelters, 3.2% expect to stay in second homes. Finally, 9.8% indicated that they don't know where they will stay or did not respond.

For those who do not plan to evacuate, the majority expect to shelter in a house (78.1%), while 14.6% expect to ride out the storm in a public shelter, 4.1% expect to stay in an apartment and 3.3% expect to stay in a mobile home. None of these intentions differs across risk areas; respondents nearest the coast are just as likely as those farther inland to expect to go to public shelters or stay in mobile homes. Those who indicated that they expected to stay in public shelters were asked where they would go if these were unavailable. A total of 36.8% indicated that they would return home, 57.3% would evacuate further inland, and only 5.8% would seek other shelter elsewhere in their risk area.

Approximately one-fifth of the questionnaire items showed differences across study areas. The items showing statistically significant differences among study areas are listed in table 6 and are discussed below.

Table 6: Summary of differences among Study Areas, by questionnaire item.

Item number	Item content	Analysis results					
		SSA	GSA	MSA	CSA	VSA	Statistical significance
1a	No hurricane experience	18%	25%	36%	5%	13%	$\chi^2_4 = 41.78$, $p < .001$
1b	Previously evacuated	56%	32%	49%	59%	56%	$\chi^2_4 = 20.10$, $p < .001$
1c	Previously stayed in house	31%	48%	13%	34%	26%	$\chi^2_4 = 21.85$, $p < .001$
1f	Previously stayed in public shelter	1%	4%	5%	0%	8%	$\chi^2_4 = 11.34$, $p < .05$
2b	Importance of local media	4.22	3.86	3.91	4.24	3.66	$F(4,250) = 2.62$, $p < .05$
3e	Would evacuate for Category 4	94%	90%	93%	81%	92%	$\chi^2_4 = 13.16$, $p < .05$
3f	Would evacuate for Category 5	95%	94%	95%	85%	94%	$\chi^2_4 = 11.48$, $p < .05$
9	Will take motor home or RV	18%	5%	15%	5%	8%	$\chi^2_4 = 16.09$, $p < .01$
12a	Will stay with friends/relatives	41%	59%	49%	58%	35%	$\chi^2_4 = 18.54$, $p < .001$
18b	Will receive a warning in time	3.80	3.87	4.02	4.20	4.30	$F(4,541) = 3.91$, $p < .01$
20	Years lived on coast	41.48	29.94	36.07	32.13	25.31	$F(4,549) = 10.25$, $p < .001$

Lake Sabine Study Area

The Lake Sabine Study Area (SSA) has a relatively small proportion of residents who lack hurricane experience because its residents have a much longer duration of residence on the coast than those in any other study area. SSA residents tend to place greater reliance on the local newsmedia than do most other coastal residents, but tend to have a lower than average level of confidence that they will receive a timely warning. SSA residents are much more likely to take motor homes or recreational vehicles than other coastal residents and a significant proportion of them will stay in these during evacuation rather than with friends or relatives.

SSA respondents expected to travel to a multitude of different locations. The major metropolitan destinations—Dallas, Houston, Austin, and San Antonio—are reported directly in Tables 7, 9, 11, 13, and 15, below. Small towns were coded into five principal areas. East Texas was defined as consisting of the area east of I-45, whereas North Texas was defined as the area north of I-20. West Texas is the area bounded by I-35 on the east and US-90 on the south, and South Texas is the area south of US-90 and west of I-37. Central Texas is the area bounded by I-45 on the east, I-20 on the north, I-35/I-37 on the west.

Table 7 indicates that a sizeable proportion of the SSA respondents (48.4%) expect to go to destinations in East Texas and smaller percentages of them expect to continue on to North Texas and Dallas (5.4%) or go to Central Texas (10.8%). All of these destinations are compatible with existing evacuation traffic management plans because the most logical routes to these destinations lead directly inland from the risk areas. It is important to note that a significant portion of the respondents (12.9%) expect to go to Houston, Austin, San Antonio, or West Texas (see Table 7, Rows 6–9).

Table 7: Lake Sabine Study Area (SSA) Expected Evacuation Destinations

Destination	Frequency	Percent
1. Inland SSA	1	1.1
2. East TX	45	48.4
3. North TX	4	4.3
4. Dallas	1	1.1
5. Central TX	10	10.8
6. Houston	4	4.3
7. Austin	4	4.3
8. San Antonio	3	3.2
9. West TX	1	1.1
10. Out of state US	4	4.3
11. No destination listed	16	17.2
12. Total	93	100.0

This is potentially problematic because I-10 is the most direct route to these destinations and Table 8, Row 1 confirms that 18.3% of the respondents intend to use I-10 to leave the study area. However, current plans call for I-10 to be used principally as a lateral feeder to northbound evacuation routes; SSA residents' attempts to access I-10 to travel to Houston and points west could disrupt the orderly flow of northbound traffic, so it is important that traffic control points

be staffed early and that local officials inform evacuees of appropriate routes to their intended destinations.

Table 8: Lake Sabine Study Area (SSA) Expected Evacuation Routes

Route	Frequency	Percent
1. I-10	17	18.3
2. SH-12	2	2.2
3. SH-87	7	7.5
4. SH-62	12	12.9
5. US-287	4	4.3
6. US-90	2	2.2
7. SH-146	2	2.3
8. Multiple routes	9	9.7
9. Unofficial routes	32	34.4
10. No route listed	6	6.5
11. Total	93	100.0

Table 8 shows that the traffic load is likely to be reasonably well distributed over a large number of the listed evacuation routes and 34.4% of the respondents intend to evacuate on highways other than the official routes. This suggests that traffic loads will not be as heavy on the official routes as if all evacuees took these routes. However, it also is possible that traffic jams could develop on these routes if they are not monitored or controlled by state and local law enforcement officials and that such traffic jams could back up onto the officially designated routes.

Finally, Table 8 indicates that 17.2% of the respondents did not list an evacuation destination and 6.5% did not list an evacuation route. Until they can decide where to go and how to get there, these households are likely to delay the initiation of their evacuation and thus delay clearance of the risk area.

Houston/Galveston Study Area

The Houston/Galveston Study Area (GSA) has a higher than average proportion of residents with no hurricane experience probably because they have a somewhat shorter than average duration of residence on the coast. GSA has the lowest proportion of evacuees (and conversely, the highest proportion of non-evacuees) of any study area. This should not be misinterpreted to mean that these residents are less likely to evacuate in a future hurricane because they did not differ from the others with respect to their evacuation intentions. GSA residents tend to have low confidence in local media and a lower than average level of confidence that they will receive a timely warning. A relatively low proportion of them plan to take motor homes or recreational vehicles during an evacuation and a very high percentage will stay with friends or relatives.

Table 9 shows that the GSA respondents expect to be spread out over a variety of destinations. The largest number expect to go to inland locations within GSA (19.7%) and most of the remainder expect to go to Dallas (16.2%), East Texas (13.7), or Central Texas (12.0%). The fastest route to these destinations under normal conditions is I-45 and their popularity suggests that another hurricane evacuation could cause a traffic jam on that route similar to the one that

occurred on I-37 between Corpus Christi and San Antonio during the evacuation from Hurricane Bret. Approximately one-sixth of the respondents did not specify a destination.

Table 9: Houston/Galveston Study Area (GSA) Expected Evacuation Destinations

Destination	Frequency	Percent
1. Inland GSA	23	19.7
2. East TX	16	13.7
3. North TX	6	5.1
4. Dallas	19	16.2
5. Central TX	14	12.0
6. Austin	10	8.5
7. San Antonio	7	6.0
8. South TX	2	1.7
9. Out of state US	4	3.4
10. No destination listed	16	13.7
11. Total	117	100.0

Concern about overloading I-45 is supported by data from Table 10 showing that a large percentage of respondents (41.9%) indicated that this would be their evacuation route. There is a sizeable fraction of the respondents who listed multiple routes (23.9%) or other routes that are not officially designated for hurricane evacuation (9.4%). These respondents probably will take a significant load off the official routes, but it also is possible that traffic jams could develop on these unmonitored routes and that such traffic jams could back up onto the officially designated routes. Only a very small percentage of the GSA respondents failed to list an evacuation route (6.8%).

Table10: Houston/Galveston Study Area (GSA) Expected Evacuation Routes

Route	Frequency	Percent
1. SH-146	4	3.4
2. I-45	49	41.9
3. SH-225	1	0.9
4. I-10	11	9.4
5. SH-3	1	0.9
6. SH-6	4	3.4
7. Multiple routes	28	23.9
8. Unofficial routes	11	9.4
9. No route listed	8	6.8
10. Total	117	100.0

Matagorda Study Area

The Matagorda Study Area (MSA) has the highest proportion of residents without hurricane experience, but has a high level of evacuation among those who have been received a hurricane warning. MSA residents are among the most likely to evacuate for hurricanes in Categories 4 and 5 and low confidence in local media. They are much more likely to take motor homes or

recreational vehicles than most other coastal residents and some of them will stay in these during evacuation rather than with friends or relatives.

Table 11 shows that the largest number of MSA respondents expect to go to San Antonio (26.4%) and most of the remainder expect to go to Central Texas (16.0%), South Texas (16.0%), or Austin (15.1%). Another 16.0% of the respondents did not specify a destination.

Table 11: Matagorda Study Area (MSA) Expected Evacuation Destinations

Destination	Frequency	Percent
1. Inland MSA	2	1.9
2. East TX	2	1.9
3. North TX	2	1.9
4. Dallas	3	2.8
5. Central TX	17	16.0
6. Houston	2	1.9
7. Austin	16	15.1
8. San Antonio	28	26.4
9. South TX	17	16.0
10. No destination listed	17	16.0
11. Total	106	100.0

Despite the variety of destinations that lie in different directions, data from Table 10 show that a large percentage of respondents (41.5%) expect to use US-87 as their evacuation route. This concentration of evacuees on a single route has the potential to cause significant delays in an evacuation.

There also is a sizeable fraction of the respondents who listed routes that are not officially designated for hurricane evacuation (19.8%). These respondents will take a significant load off the official routes, but it appears that demand will be reduced only on underutilized routes and would, therefore, not reduce any congestion on US-87. It also is possible that traffic jams could develop on these unmonitored routes and that such traffic jams could back up onto the officially designated routes. There also was a significant fraction who did not list an evacuation route (13.2%). These could add to the congestion on US-87 if a significant portion of them elect to use this route. Moreover, these households are likely to delay the initiation of their evacuation and thus delay clearance of the risk area until they can decide where to go and how to get there.

Table 12: Matagorda Study Area (MSA) Expected Evacuation Routes

Route	Frequency	Percent
1. SH-60	6	5.7
2. SH-35	7	6.6
3. SH-71	9	8.5
4. SH-185	1	0.9
5. US-87	44	41.5
6. Multiple routes	4	3.8
7. Unofficial routes	21	19.8

8. No route listed	14	13.2
9. Total	106	100.0

Coastal Bend Study Area

The Coastal Bend Study Area (CSA) has the lowest proportion of residents without hurricane experience, undoubtedly because of Hurricane Bret. CSA has a very high proportion of residents who complied with the evacuation warning, but also a high proportion who ignored the warning and remained at home. CSA has the highest percentages of respondents who intend to stay at home during future Category 4 and 5 hurricanes. CSA residents have higher confidence in local media than most of the other coastal residents and have a higher level of confidence that they will receive a timely warning. CSA respondents expect to take a lower than average number of recreational vehicles and are more likely than others to plan to stay with friends and relatives during their evacuation.

Table 13 shows that the majority of the Coastal Bend Study Area (CSA) respondents expect to go to San Antonio (36.0%) and most of the remainder expect to go to Austin (11.8%) or Central Texas (8.8%). The fastest route to these destinations under normal conditions is I-37 and their popularity suggests that another hurricane evacuation could cause a replay of the traffic jams that occurred during the evacuation from Hurricane Bret. Approximately one-sixth of the respondents expect to travel to destinations in South Texas and another one-fifth did not specify a destination.

Table 13: Coastal Bend Study Area (CSA) Expected Evacuation Destinations

Destination	Frequency	Percent
1. East TX	2	1.5
2. North TX	1	0.7
3. Central TX	12	8.8
4. Houston	4	2.9
5. Austin	16	11.8
6. San Antonio	49	36.0
7. Inland CSA	2	1.5
8. South TX	19	13.9
9. No destination listed	31	22.8
10. Total	136	100.0

Concern about overloading I-37 is supported by data from Table 14 showing that a large percentage of respondents (30.1%) indicated that this would be their evacuation route. Moreover, if the 16.9% who did not list an evacuation route decided to take the most familiar route (I-37), this could raise the percentage of evacuees on that route to 54.1%. These households also are likely to delay the initiation of their evacuation and thus delay clearance of the risk area until they can decide where to go and how to get there.

As is the case in other study areas, there is a sizeable fraction of the respondents who listed multiple routes (13.2%) or other routes that are not officially designated for hurricane evacuation (14.0%). These respondents probably will take a significant load off the official routes, but it also is possible that traffic jams could develop on these unmonitored routes and that such traffic jams could back up onto the officially designated routes.

Table 14: Coastal Bend Study Area (CSA) Expected Evacuation Routes

Route	Frequency	Percent
1. US-77	14	12.4
2. US-183	2	1.8
3. US-181	15	13.3
4. FM-666	1	.9
5. I-37	42	37.2
6. FM-624	1	.9
7. SH-44	1	.9
8. Multiple routes	18	15.9
9. Unofficial routes	19	16.8
10. No route listed	23	16.9
11. Total	136	100.0

Rio Grande Valley Study Area

The Rio Grande Valley Study Area (VSA) has a high proportion of residents with hurricane experience, even though it has the lowest average number of years of residence on the coast. As was the case for CSA, this probably is because of Hurricane Bret. VSA has a very high proportion of residents who complied with previous evacuation warnings, and a relatively low proportion who ignored these warnings. VSA residents have lower confidence in local media than most other coastal residents, but nonetheless have a very high level of confidence that they will receive a timely warning. They also are above average in their intentions to evacuate in a Category 4 or Category 5 hurricane. They have the lowest level of intention to stay with family and friends of any study area. This may be because these people live within one of the risk areas or in Mexico and also will need to evacuate. Conversely, VSA residents have the highest level of prior usage of shelters.

As Table 15 indicates, the majority of the VSA respondents expect to go to destinations in South Texas (36.4%) and most of these will be in towns farther up the Rio Grande River Valley. Just under one-fifth of them (18.7%) expect to go to San Antonio and, as was the case with the other study areas, a significant proportion of the respondents (15.9%) did not list an evacuation destination. However, unlike the other study areas, a significant portion of the VSA respondents listed destinations within the VSA study area. These destinations would be unavailable in a Category 5 hurricane, so these evacuees would need to find alternate destinations.

Table 15: Rio Grand Valley Study Area (VSA) Expected Evacuation Destinations

Destination	Frequency	Percent
1. North TX	1	0.9
2. Dallas	1	0.9
3. Central TX	2	1.9
4. Houston	2	1.9
5. San Antonio	20	18.7
6. Inland VSA	14	13.1
7. South TX	39	36.4
8. Out of state US	1	0.9
9. Mexico	2	1.9
10. West TX	3	2.8
11. No destination listed	17	15.9
12. Total	107	100.0

Table 16 shows that the VSA respondents intend to distribute themselves relatively evenly across the available evacuation routes and a significant portion of them intend to use unofficial evacuation routes (42.1%). Both of these factors should reduce the likelihood of traffic jams during hurricane evacuation. The percentage of VSA respondents who listed multiple routes (6.3%) or no evacuation route (11.2%) is relatively small. Thus, there is less uncertainty about the traffic demand on primary evacuation routes when authorities initiate and evacuation. In addition, this means that there are likely to be fewer households that delay initiating evacuation because they have not selected an evacuation route or destination.

Table 16: Rio Grand Valley Study Area (VSA) Expected Evacuation Routes

Route	Frequency	Percent
1. US-77	2	1.9
2. SH-186	6	5.6
3. US-83	19	17.8
4. BR-77/83	12	11.2
5. US-281	10	9.3
6. Multiple routes	6	5.6
7. Unofficial routes	40	37.4
8. No route listed	12	11.2
9. Total	107	100.0

DISCUSSION

The results of this survey indicate that the majority of the respondents have experienced a hurricane and most of them evacuated in response to this threat. This high level of previous hurricane experience suggests that the respondents were able to provide accurate answers to the questions about what they would expect to happen and what they plan to do in a future emergency. Of course, the fact that people evacuated in the past does not necessarily mean they will evacuate in the future, especially if they considered the past evacuation to be a false alarm that should not be repeated. However, the data from Table 4 indicate that the majority of those

who evacuated in the past intend to do so in future hurricanes (82.6%) an a substantial number intend to evacuate even if an adjacent risk area is warned to do so (40.7%). These levels exceed the corresponding figures for those who have never experiences a hurricane (77.4% and 24.2%, respectively). Indeed, nearly half of those who ignored an evacuation warning in the past intend to evacuate promptly in the future (45.2%) or to evacuate if an adjacent risk area is warned to do so (12.9%).

The respondents' concerns about storm risks (high winds and flooding) are quite high and would be expected to lead them to comply promptly with official evacuation recommendations. However, they also have significant concerns about traffic accidents, looting, loss of income, and out of pocket expenses—concerns that would tend to inhibit evacuation. There is little that officials can do about loss of income and out of pocket expenses, but they can enhance evacuation warning compliance by reassuring risk area residents that serious traffic accidents are unlikely and traffic fatalities are extremely improbable. Moreover, local authorities can publicize the existence of security measures that will be taken to prevent looting while evacuees are away from home.

Concerns about warning accuracy are well-founded because there will be a significant level of forecast error at the time evacuations need to be initiated. Indeed, the fact that differences in storm category have a much more substantial effect on evacuation intentions than differences in risk area suggests that respondents are very concerned about the potential for last-minute increases in storm intensity or point of landfall and wish to avoid being forced to remain at home riding out a storm that turns out to be significantly more intense than initially predicted. This explanation also is consistent with the finding that as many as one quarter of the residents in Risk Areas 2-5 and 40% of those in Risk Area 1 intend to evacuate if an adjacent risk area is advised to do so. The first of these results indicates that local officials should expect a significant level of evacuation in risk areas farther inland than the ones for which an evacuation advisory has been issued. The second result indicates that evacuation shadow is likely to be stronger *along* the coast than inland from it.

It is notable that the intended number of evacuating vehicles per household (1.62 VPH) is somewhat higher than that reported in previous evacuations (1.26 VPH in Dow & Cutter, 2000; 1.33 VPH in Lindell & Perry, 1992; 1.34 VPH in Prater, Wenger & Grady, 2000; and a range of 1.21–1.54 in Post, Buckley, Schuh & Jernigan, 1999). One explanation for this result is that, while filling out the questionnaires, the respondents probably thought that taking more cars would protect more of their property from the impact of a storm. In fact, however, people tend to take fewer cars during an actual evacuation so they can keep the household intact. However, this does not explain why the intended number of evacuating vehicles is higher than in previous surveys of Texas Gulf Coast residents' evacuation intentions (1.35 VPH in Ruch & Schumann, 1997, and 1.41 VPH in Ruch & Schumann, 1998). An explanation for this discrepancy is that the number of registered vehicles per household has been increasing during recent years, so the respondents' reports of their plans might be an accurate indication of their evacuation behavior in future hurricanes. If this 20% increase in evacuation traffic does materialize, it could further strain the capacity of evacuation routes leading out of the risk areas.

The data on expected evacuation routes and destinations indicate that the majority of respondents plan to take officially designated evacuation routes to leave the risk area, but a substantial number expect to take multiple routes or unofficial routes, or could not say what route they would take. Those who plan to take unofficial routes probably will take a significant load off the official routes, but there is a possibility that traffic jams could develop on these unmonitored routes and that such traffic jams could back up onto the officially designated routes. Thus, local officials should monitor the progress of the evacuation closely and be prepared to direct traffic onto predetermined alternate evacuation routes that have underutilized capacity.

Tables 8, 10, 12, 14, and 16 clearly indicate that traffic demand is unlikely to be allocated equally across evacuation routes. The potential for a mismatch between traffic demand (evacuating vehicles) and traffic capacity (evacuation routes) should be taken very seriously for two reasons. First, the evacuation time estimation procedure currently in use *assumes* that evacuating vehicles will distribute themselves equally across the available evacuation routes (e.g., Ruch & Schumannn, 1997, 1998). This assumption is problematic because there is no obvious way in which evacuees can achieve this by themselves and current evacuation management technology gives local authorities only a limited ability to control the allocation of vehicles to evacuation routes. Moreover, evidence from previous hurricane evacuations suggests that there is likely to a demand/capacity mismatch in future evacuations. Specifically, most of those who evacuated from Corpus Christi during Hurricane Bret chose to take I-37 inland to San Antonio even though additional evacuation routes were listed in local emergency plans and printed on risk area maps distributed to local emergency management agencies. A larger than expected number of vehicles per hour combined with a more concentrated than planned route selection to cause severe congestion on I-37 and trip durations of ten hours were not unusual. There was no loss of life, but this may have been due in part to the fact that the storm turned west before striking Corpus Christi and made landfall farther south along the coast in Kenedy County, the least populated jurisdiction on the entire Gulf Coast (Prater, et al., 2000).

Similar problems arose during Hurricane Floyd. For days, this storm had moved parallel to the Atlantic coast on a northward course from Florida, causing evacuations in Florida and Georgia that also moved northward up the coast. On September 14, 1999, the South Carolina governor responded to the hurricane threat by ordering a mandatory evacuation of the state's coastal counties, which include the cities of Charleston and Myrtle Beach. As many as a half-million risk area residents evacuated, causing a major traffic jam on I-26, the interstate highway leading inland from Charleston. Traffic congestion was increased by two factors. The first of these was that evacuees from Florida and Georgia were traveling north on I-95 parallel to the coast and crossing I-26 approximately 50 miles inland. The second cause of the traffic jams was the overloading of I-26 and underutilization of alternate evacuation routes paralleling it. Travel times on I-26 increased by as much as an order of magnitude but, as with Hurricane Bret, did not result in a loss of life (Dow & Cutter, 2001).

In future hurricane evacuations, the threat to human life will depend not only upon whether traffic jams materialize but also on whether they are located inside or outside the risk area. A significant loss of life might occur vehicles attempting to evacuate are forced to remain inside the risk area. By contrast, a traffic jam located entirely outside the risk area might be very unpleasant and perhaps even frightening but not life threatening.

The survey data on expected evacuation routes and destinations indicate that inland evacuation routes also need further analysis and planning. Selection of inland evacuation routes is not a significant problem for evacuees who will continue to travel away from the coast because the identity of these routes is obvious, the demand for them decreases with distance from the risk area, and the safety hazards (especially storm risks) also decrease with distance from the risk area. However, identifying appropriate inland evacuation routes may be a problem for evacuees who expect to travel parallel to the coast on their way to their evacuation destinations because the most direct routes could have a significant risk from overcrowding during storm conditions. Further analyses are needed to identify suitable inland evacuation routes to all of the major evacuation destinations listed by respondents in each of the study areas. In addition to identifying safe routes that parallel the coast, emergency managers should inform risk area residents which routes will be closed, which routes are likely to be overloaded, and which routes are recommended.

The percentage of respondents in this survey who expect to take their own vehicles (97.5%) is higher than the proportion of respondents who reported having taken their own vehicles when evacuating from Hurricane Bret (87.8%—Prater, et al., 2000). Moreover, the percentage of respondents in this survey who expect to stay with friends and relatives (49.1%) is lower than the proportion of respondents who reported having stayed with friends and relatives when evacuating from Hurricane Bret (62.0%—Prater, et al., 2000).

The percentage of respondents indicating that they expect to stay in public shelters (3.2%) is below the 5-15% range that would be expected on the basis of previous evacuation research (Lindell & Perry, 1992; Post, Buckley, Schuh & Jernigan, 1999). Those respondents who expect to stay in a local shelter (i.e., within the study area) rather than evacuating out of the study area (13.7% of the respondents) are a potential problem if local authorities do not plan to open such shelters. If shelters will not be opened in the study areas, this needs to be publicized to ensure that people do not delay their evacuations for this reason.

It is important to recognize the limitations of the data reported here. First, as noted earlier, the response rate was low despite repeated contacts. A low response rate raises the possibility that those who did respond were atypical of the communities from which they were selected. As noted earlier, the demographic data suggest that this was the case. However, the fact that the respondents were systematically different from their communities in terms of their demographic characteristics does not necessarily mean that their hurricane evacuation behavior also will be systematically different from other residents of their communities. Contrary to previous research, that men were slightly more inclined to initiate a sympathetic evacuation in response to evacuation of an adjacent risk area. However, this gender effect was small (less than ten percentage points). Moreover, the fact that households evacuate as a unit during disasters would tend to further reduce this gender effect because both partners will be involved in a decision that would, presumably, reflect a compromise between the two individuals' preferences.

Similarly, one might conclude that the overrepresentation of homeowners, who tend to have higher incomes than renters, is likely to have yielded overestimates of the number of vehicles, trailers, and motor homes/recreational vehicles that will be taken during evacuation. Conversely,

the high proportion of homeowners also is likely to have yielded underestimates of the proportion of risk area residents who will need transportation assistance during, or public shelter after, evacuation. However, analyses conducted on all of these variables indicated that homeowners did not differ significantly from renters with respect to these variables. Thus, projections based upon the survey estimates do not appear to be biased by home ownership (and, implicitly, income) effects.

A second limitation of this study is that it only addresses the general population of risk area residents having their own vehicles and a high level of personal mobility. It does not address special populations in jails, hospitals, and nursing homes. Such groups, together with school children, require separate analyses.

Finally, it also is important to recognize that hurricanes are infrequent events and that hurricane conditions vary so much that even people who have had hurricane experience will encounter conditions that differ significantly from their expectations about what will happen. Thus, people's actual behavior during an emergency is likely to differ from their behavioral intentions expressed before the emergency to the extent that the conditions arising during an emergency differ from their expectations before the emergency. Consequently, emergency planners should recognize that the behavior of the risk area population might differ—perhaps significantly—from the intentions expressed in response to this questionnaire. Emergency operations plans, especially evacuation annexes, need to be flexible enough to adapt to unexpected storm conditions and the changes that these might cause in the responses of risk area residents.

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Texas Hurricane Evacuation Questionnaire

1. If you have ever been in an area that was advised to evacuate from a hurricane, what did you do? (check only one of the following alternatives)
   - My area has never been hit by a hurricane while I have lived here __①__
   - I evacuated the area before the hurricane hit __②__
   - I stayed in my house __③__
   - I stayed in my apartment __④__
   - I stayed in my mobile home __⑤__
   - I stayed in a local hurricane shelter __⑥__

2. If you have *never* evacuated inland because of a hurricane, skip to Question 3.
   If you *have* evacuated inland because of a hurricane, to what *extent* did the following considerations affect your decision? (check one response for each item)…

		Not at all				**Very great extent**
a.	Recommendation by local authorities	①	②	③	④	⑤
b	Information from the local media	①	②	③	④	⑤
c.	Information from the national media (such as the Weather Channel)	①	②	③	④	⑤
d.	The posting of a hurricane “watch” or “warning”	①	②	③	④	⑤
e.	The departure of friends, relatives or neighbors	①	②	③	④	⑤
f.	Storm related conditions (such as high winds, rain or flooding)	①	②	③	④	⑤
g.	Proximity to the coast	①	②	③	④	⑤

3. If the local authorities recommend that you evacuate for one of the following conditions, would you do so? (check one response for each item)…

		No	**Yes**
a.	Tropical Storm	①	②
b.	Category One Hurricane	①	②
c.	Category Two Hurricane	①	②
d.	Category Three Hurricane	①	②
e.	Category Four Hurricane	①	②
f.	Category Five Hurricane	①	②

(If you answered “no” to all of the conditions above, skip to Question 14)

4. If local authorities recommended an evacuation while you were at work, how many *minutes* would it take for you to (check one response for each item)…

		15 or less	**16-30**	**31-45**	**46-60**	**61 or more**
a.	Prepare to leave from work?	①	②	③	④	⑤
b.	Travel from your place of work to your home?	①	②	③	④	⑤
c.	Gather all of the persons who would evacuate with you?	①	②	③	④	⑤
d.	Pack the items you would need while gone?	①	②	③	④	⑤
e.	Install shutters on your windows?	①	②	③	④	⑤
f.	Shut off utilities, secure your home and leave?	①	②	③	④	⑤

5. If evacuation were recommended for your area, would you respond immediately? ① **No** ② **Yes**

6. What form of transportation would you use to evacuate? (check only one of the following alternatives)
   - Take my own private vehicle __①__
   - Get a ride with a friend, relative, neighbor, or coworker __②__
   - Use public transportation __③__
   - Other (please specify)_____ __④__

7. How many vehicles would your household take with you in an evacuation? _____ **Vehicles**

8. How many trailers (including boats & campers) would your household take with you in an evacuation? _____ **Trailers**

9. Would the vehicles you take include a motor home or recreational vehicle? ① **No** ② **Yes**

10. What city would be your final destination if you did choose to evacuate? _____

11. What major highways would you take during your evacuation to this destination? _____

_____

Please go to the next page.

12. Where would you stay while away from home during a hurricane evacuation? (check only one of the following alternatives)
    - With friends or relatives __①__
    - In a hotel or a motel __②__
    - In a public hurricane shelter __③__
    - Other (please specify)_____ __④__
    - Don't know __⑤__

13. If local authorities recommended an evacuation for any of the risk areas next to yours on the enclosed Risk Area Map, *but not for your area,* would you leave? ..... ① **No** ② **Yes**

14. If you choose *not to evacuate* when local authorities issue an evacuation recommendation, in what type of structure would you stay? (check only one of the following alternatives)
    - In a house (single family dwelling) __①__
    - In an apartment (multi-family dwelling) __②__
    - In a mobile home __③__
    - In a public hurricane shelter __④__

    (If you do not intend to stay in a public hurricane shelter, skip to Question 16)

15. If you choose *not to evacuate* and plan to stay in a local hurricane shelter but none is available, what would you do? (check only one of the following alternatives)
    - Return to my home __①__
    - Go to the home of a friend or relative in the same risk area __②__
    - Go to the home of a friend or relative further inland __③__

16. If local authorities recommend evacuation for your neighborhood, *to what extent* would the following considerations affect your decision whether or not to evacuate? (check one response for each item)…

	Not at all				**Very great extent**
a. The possibility of being involved in a major traffic accident	①	②	③	④	⑤
b. The possibility of being caught in severe winds or flooding	①	②	③	④	⑤
c. Loss of income while away from work	①	②	③	④	⑤
d. Out of pocket expenses while away from home	①	②	③	④	⑤
e. The possibility of looting in evacuated areas	①	②	③	④	⑤

17. How *likely* do you think it is that there will be a hurricane this year that will cause (check one response for each item)…

	Not at all likely				**Almost certain**
a. Major damage to property in your area?	①	②	③	④	⑤
b. Major damage to your home?	①	②	③	④	⑤
c. Injury to yourself or members of you household?	①	②	③	④	⑤
d. Disruption of your job that prevents you from working?	①	②	③	④	⑤
e. Disruption of electrical, telephone and other basic services?	①	②	③	④	⑤

18. If local authorities recommend evacuation for your neighborhood, how *likely* do you think it is that (check one response for each item)…

	Not at all likely				**Almost certain**
a. The hurricane would actually strike your neighborhood?	①	②	③	④	⑤
b. You would get the message in time to evacuate safely?	①	②	③	④	⑤

	Risk Area					**None**
19. Based on the enclosed Risk Area Map, in which Risk Area do you currently live?	①	②	③	④	⑤	⑥

20. How many years have you lived in the coastal area of Texas..... _____ **years**

21. How many people live in your household? ..... _____ **persons**

22. How many children (less than 18 years of age) live in your household? ..... _____ **children**

23. Do you rent or own the home where you are currently living? ..... ① **Rent** ② **Own**

24. What is your age in years? ..... _____ **years**

25. What is your sex? ..... ① **Male** ② **Female**

This concludes the survey. **Thank You.**